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ABSTRACT

This literature review presents a broad and overall perspective on the various kinds of information networks that will be useful to educators in developing nations. There are five sections to the essay. The first section cites and briefly describes the literature dealing with library, information, and computer networks. Sections two and three examine social networks which are defined as connections between individuals, groups, and institutions through which information passes back and forth. Networks within and between organizations is the topic of the literature search in section four. The fifth section is on diffusion/exchange of new ideas, practices, and theories. A summary of the essay indicates that there is a relative lack and unevenness of documentation. No citations were found, for example, on how to organize, build up, and maintain a formal cooperative library network. Included among the recommendations to Unesco were that it focus further on the question of users; the form in which they need information, and the best means of delivering it to them: and that it examine the formal system/informal network interface by looking further into such intermediaries as information brokers, gatekeepers, and others who may actively guide and assist users. It was also suggested that Unesco compare library networks with the news media to discover to what extent outreach can be improved and what lessons news organizations may have to offer. (Author/RM)

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INFORMATION NETWORKS AND EDUCATION: AN ANALYTIC BIBLIOGRAPHY

by

Roger Pritchard

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FOREWORD

Unesco's General Conference at its 19th session (Nairobi, Kenya, 1976) resolved that the Secretariat give particular attention to "gathering and disseminating information about new educational policies for the renewal of educational systems, adapted to specific needs on the basis of particular social, economic and cultural situations and aimed at promoting democratization of the systems within the framework of life-long education" (Programme Resolution 1.111).

In line with this mandate the Division of Educational Policy and Planning began in 1977 reproducing selected technical papers and distributing them as a series under the general title: "Reports, Studies ...". The aim of this series is to stimulate reflection and discussion on current issues confronting educational policy-makers, planners, administrators and school architects. Distribution is limited to Unesco officials at Headquarters and in the field, as well as interested technical personnel in governmental and private institutions. It is hoped that this series will promote and serve as a vehicle for increasing communication between individuals and institutions concerned with policy and planning aspects of education.

The "Reports, Studies ..." series consists of two sub-series : (i) papers with a subject orientation (numbered S.1, S.2, etc.) and (ii) papers focusing on a given country (numbered C.1, C.2, etc.). Subject papers deal with such topics as educational policies and legislation, planning and management techniques, planning and design of educational space and facilities, the relationship of education to productive work and employment, inter-country cooperation, the role of education in respect of the New International Economic Order, etc. Country papers are either brief profiles of the educational system of a particular country (mainly the LDCs) or treat a specific reform or aspect of the country's educational system.

Some of the papers reproduced in the series are "desk studies" based on information available within Unesco, others were originally prepared as background or discussion papers for a meeting or seminar, while still others are personal position papers representing part of a continuous dialogue within the Unesco Secretariat.

Papers are selected for the series on the basis of their topical interest. Readers should bear in mind that many, if not most, of the papers are working documents, unedited and not intended for public distribution. Some of the authors have written in a language other than their mother tongue, which explains certain linguistic deficiencies. It must also be stressed that the papers present the ideas of their respective author and do not necessarily reflect the policies of Unesco.

The Division of Educational Policy and Planning welcomes comments and suggestions concerning the series and invites readers to make known their reactions to particular ideas presented or to entire papers. In certain cases it may be possible to reproduce such comments and reactions in a subsequent issue of the series. For the convenience of readers who may wish to contact the author of a paper, the current contact address is given whenever possible.

AVANT PROPOS

La Conférence Générale de l'Unesco, lors de sa 19e session (Nairobi, Kenya, 1976) a décidé que "la collecte et la dissémination de l'information sur les nouvelles politiques d'éducation pour le renouvellement et la réforme des systèmes d'éducation adaptés aux besoins spécifiques basés sur des situations sociales, économiques et culturelles particulières et qui ont comme objectif la démocratisation des systèmes dans le cadre de l'éducation permanente" (Résolution 1.111 du programme) se situent parmi les objectifs prioritaires de l'Organisation.

Conformément à ce mandat, la Division des politiques et de la planification de l'éducation a entrepris en 1977 la reproduction et la distribution de certains documents techniques, sous le titre général de "Rapports et Etudes ...". Cette série a pour objet de stimuler la réflexion et les discussions portant sur les problèmes courants auxquels doivent faire face les décideurs, les planificateurs et les administrateurs de l'éducation ainsi que les architectes scolaires. La distribution se limite aux professionnels du Siège et hors-Siège, ainsi qu'aux personnels d'institutions gouvernementales ou privées susceptibles de les trouver utiles pour leur travail. Nous espérons que cette série constituera un moyen pour promouvoir et augmenter la communication entre les individus et les institutions concernés par les différents aspects des politiques et de la planification de l'éducation.

Ces "Rapports et Etudes ..." se divisent en deux catégories: (i) les documents qui traitent d'un sujet (numérotés S.1, S.2, etc.) et (ii) les documents qui traitent d'un pays (numérotés C.1, C.2, etc.) Les premiers portent sur des sujets tels que les politiques et la législation de l'éducation, les techniques de gestion et de planification, la planification et l'étude des espaces, constructions et équipements éducatifs, la relation entre éducation/travail/emploi, la coopération entre les pays, le rôle de l'éducation par rapport au Nouvel ordre économique international, etc. Les seconds présentent des profils du système éducatif d'un pays donné (principalement les pays les moins développés), ou traitent d'une réforme ou d'un aspect spécifique du système éducatif du pays concerné.

Certains des documents reproduits dans cette série sont des "desk studies" basés sur des informations déjà existantes à l'Unesco, d'autres ont été préparés à l'origine pour servir de documents de base ou de discussion à des réunions ou séminaires, alors que d'autres encore, exprimant les positions personnelles des auteurs, se situent dans le cadre d'un dialogue permanent au sein du Secrétariat de l'Unesco.

Les documents sont choisis pour cette série en fonction de l'actualité du sujet traité. Les lecteurs doivent tenir compte du fait que beaucoup, sinon la plupart, des documents sont des documents de travail inédits et ne sont pas destinés au public. Certains auteurs ont rédigé ces documents dans une langue qui n'est pas la leur, ce qui explique certaines faiblesses linguistiques. Nous voudrions également souligner que les documents expriment les idées de leurs auteurs respectifs et ne reflètent pas nécessairement la politique de l'Unesco.

La Division des politiques et de la planification de l'éducation souhaite recevoir des commentaires ou suggestions au sujet de la série, et demande aux lecteurs de bien vouloir faire part de leurs réactions à certaines idées exprimées ou à des documents dans leur ensemble. Dans certains cas, il sera peut-être possible de reproduire ces commentaires et réactions lors d'une prochaine parution de la série. Les adresses des auteurs des documents sont indiquées afin de donner aux lecteurs qui le désirent la possibilité d'entrer en contact avec eux.

RESUME

LES RESEAUX D'INFORMATION ET L'EDUCATION : UNE BIBLIOGRAPHIE ANALYTIQUE

Cette publication a été préparée à la suite d'une recommandation faite lors d'un "Symposium sur les Programmes futurs de l'Information et de la Communication en Politiques et Planification de l'Education" organisé par l'Unesco en novembre 1978.

M. Pritchard, Coordonnateur de Réseau d'Information de l'Université de Californie, Berleley, a également présenté à ce Symposium un document sur : "Comment organiser un Réseau International d'Information en Education : Processus et Problèmes", (Rapports et Etudes, Séries no. S.46).

Le but principal de ce document est d'étudier l'ensemble des perspectives générales sur les réseaux d'information. Dans la première partie de son étude, l'auteur fait l'analyse des principales publications sur ces réseaux. Dans ce contexte, il donne une préférence à une vue globale des réseaux d'information et soutient qu'il y a d'autres formes de réseaux, quelquefois plus importantes, qu'une bibliothèque ou autres systèmes officiels d'information par lesquels il y a échange d'informations et par conséquent communication.

Il distingue 5 formes importantes de réseaux d'information :

(i) les moyens de transmission

(ii) les dispositions inter-organisations

(iii) les éléments nécessaires pour l'intégration des sociétés

(iv) les moyens d'organisation pour individuels, groupes et institutions, et

(v) les formes d'organisation nécessaire pour toutes sociétés à notre époque.

La bibliographie est basée le plus possible sur cette division analytique.

Dans la deuxième partie de cette publication, l'auteur s'occupe plus particulièrement des éléments sélectionnées dans la bibliographie, basés sur les 5 sections analytiques suivantes :

1. Informations, bibliothèques et réseaux/systèmes d'information
2. Réseaux d'information sociale, en général
3. Réseaux d'information sociale, appliqués
4. Réseaux à l'intérieur des organisations et entre organisations
5. Diffusion/échange d'idées nouvelles, applications pratiques etc..

En conclusion, l'auteur insiste sur le fait que, quand les réseaux sont à la base et de nature égalitaire, leurs membres s'enthousiasment considérablement, prennent position, échangent des idées et apportent leur contribution.

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> "There is much information about networking around, but much of it is complex and confusing, with implications for practice unclear ..... [It] is a quite uncertainly-understood process at best. We have only a rough set of possibilities in front of us."
>
> (Miles, 1978)

Introduction

This analytic bibliography has been prepared pursuant to a recommendation of the November 1977 Unesco Symposium on Future Programmes of Information and Communication in Educational Policy and Planning. That Symposium was a 'technical' follow-up to the 36th Session of the International Conference on Education, held in Geneva in August 1977 on the theme of the problem of information at the national and international levels posed by the improvement of educational systems.

The Unesco Secretariat, aware of the need to throw more light on the operations of information networks at the national, regional and international levels in education, has commissioned this work in order to examine the future contribution of networking to international cooperation in the educational information area.

The November Symposium's conclusions, as reported by Eide (1978), include one to the effect that only the surface of the issues in the information/communication field in education has been scratched and that there remains a great deal to be done. With reference to the use and

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*The direct assistance of over 100 people who provided information for this analytic bibliography is acknowledged with thanks. Particular thanks are owed to Mr. Hans Reiff of Unesco/EPP and Dr. James B. Chandler of the International Bureau of Education who acted as excellent information facilitators. Naturally, the stance, analysis and opinions expressed here do not necessarily reflect those of the contributors or of Unesco. Thanks are also due to Ms. Joan Killeen for typing fast and well the final version of this report.

analysis of the concept of networks and to forms and practices in the examples of networks we have reviewed, we can state a similar conclusion, quoting Miles (above) who was only looking at one type of network--the social network devoted to change--in any case.

The concept of network, we find, has been used metaphorically and analytically in a large range of disciplines, in the natural and social sciences, to develop theory, or in applied studies. The range of cases of networks encompasses a variety of organizational forms. These forms do not necessarily correspond to the metaphorical and analytical uses of the concept.

The literature review has taken us on a far broader search than we expected. A common use of the term 'information network', and indeed one which is frequently used in Unesco, is the one used in the library/information science professions. The meaning is, interestingly, interchangeable with 'information system':

> "Although strictly speaking an information system need not be based on a network structure, the expression 'information system' and 'information network' may be considered as essentially interchangeable in the present treatment of international information exchange."
>
> (Unesco, IBE, Information Networks..... 1977)

Our review has taken us on a far broader search because the senses of both 'information' and 'network' in this usage are restricted. It has seemed important to broaden the review in order to demonstrate that there are (a) other forms of network than library and other formal information networks (whether or not these networks use telecommunications and/or computers) and (b) other forms in which information is passed on and exchanged and communication takes place.

Networks

One of the important original contributions of this analytic bibliography is to stress in review, both through the divisions in the bibliography and in this introductory essay, that the range of 'information networks' interpreted as 'networks through which information passes,' either on its own or as part of a wider exchange, is very broad.

'Network' is a term that has become extremely popular in the last ten years or so (as reflected in the clustering of dates of references in the bibliography), both among academic disciplines and among practitioners and the public. It has proved to be a satisfying term to use. Some of its major uses will be pointed out.

Generally speaking, 'network' implies connectedness, co-operation, resource-sharing and complexity of relationships, whether at the individual, group, institutional or other levels. These implications exist whatever the crosscutting variables, such as formality or informality, value-conservation or the pushing of new values, etc. Pattern and exchange are thus basic implications.

Analytically, five important senses of 'network' can be distinguished. These senses fail to be distinguished by many authors so that more confusion than necessary results.

(a) As a medium of transmission, with or without storage, exclusively. In this sense, a network exists whenever distant points are connected by a medium. This medium may move people (with information), as do roads, rail, ships and airlines, or it may move information between people, as do the mails, the telephone or the computer. When the medium is used, the rest of the organization of the information sending/receiving/exchanging may vary widely, but a network form is involved, with the potential for turning the world into a community. Here the terms 'system' and 'network' are interchangeable.

(b) As an inter-organizational arrangement to conserve financial, staff and information resources in the face of massive increases in the content--information or other services/products--and inadequate financial, etc. resources to deal with it and give service on a single institution basis. Here inter-library cooperation, inter-agency pooling of services to the community, etc. are examples. Here is indicated an adjustment to the information explosion of our century in terms of limited financial/staff resources, including rationalizing services to avoid duplication and overlap.

(c) As a necessary form for the integration of societies. *General social networks* are in this sense seen as the *basic form of social life*, and information is one of the things exchanged or channeled through them. They are *informal*. Whether people are defending their communities and values or changing them, they do so through network arrangements; and whether they are resting happily or looking out for assistance and information, they do so through network linkages. Their success and failure to reach out and the quality of their lives can be seen in terms of the networks they are in and those they reach out to. In traditional societies, this was done face-to-face but in contemporary urban societies various media assist further-reaching and more open-textured connections.

(d) As *an organizing strategy* for individuals, groups and institutions, but more likely individuals and groups, *to bring social change* and innovations into a socio-political system that is rigid, poor at adapting to change, but powerful and able to resist. Networks join and unite those who are desirous of joining in a movement to bring about change or oppose undesirable directions in which 'the System' is going. By its flexibility, egalitarianism, commitment and resource-sharing in terms of effort, finances, etc., networking in this sense is a strategy for bringing about social change. Miles (above) uses the term in this sense and even with these limits finds confusion about strategies and tactics.

(e) As a *necessary organizational form* for all societies in our age *because of* the continuation of *rapid social change*, arrival of crises, overall limited resources on the planet, and the inability of the State and traditional forms of enterprise to deal with the changes/crises/limited resources. A network organization of institutions, groups and people, across the board, is a necessary adaptive response if mankind is to survive.

The five senses, then, imply pattern, connectedness, complexity, exchange, co-operation and resource-sharing, and refer to networks (a) as a medium of transmission, (b) as an inter-organizational arrangement, (c) as an informal general basic social form, (d) as a form, more or less informal, with strategic application for movements bringing about social change, or (e) as a generally necessary, informal or formal, inter-personal or inter-organizational, form to enable adequate response of societies to rapid social change, uncertainty and limited resources.

The Bibliography

The bibliography follows these analytic divisions to the greatest extent possible. There are sections on analysis, first, followed by sections on cases. It has not been possible, given the early stages of development of the concept as an analytic tool and of networks, particularly in the context of rapid social change, as an organizing form, to achieve full integration. However, given the stage we are in and the range of ambiguity we face in using and applying the term, we have achieved a real advance on previous work.

The first analytic section is on library, information and computer networks. Here, as mentioned, network and system are interchangeable terms. Why? There are two main thrusts in the library/information science literature: one is analytic sense (a), referring to the medium, especially computers and telecommunications; the other is analytic sense (b), referring to inter-institutional resource-sharing in the face of the information explosion, given that documentation and data information is the product and/or service of these institutions. The fact that there is inter-institutional resource-sharing does not, in this case, imply anything about whether the form of organization will be hierarchical or not. That is, the inter-institutional cooperation still presupposes 'users' of the cooperative services, who are not members of the institutions. The fact that the telephone company uses a physical network does not tell us anything about whether or not it charges high rates; the fact that libraries cooperate does not tell us anything about whether a better service is provided to users. By contrast, the second part of the fourth section, on inter-institutional networks aside from libraries, etc., presupposes that networks are a distinct form of organization. They are contrasted with bureaucracies, which are found to be inappropriate in the face of rapid social change and the uncertainty it generates. In the library/information science literature, there is little, if any, discussion of inter-organizational arrangements in these terms and the novelty focus is on the technological developments of media, and their consequences. Libraries are compatible with bureaucracies in many ways.

The second analytic section broadens the sense of 'information network' found in the literature of the first section. This is mainly in analytic sense (c), general informal social networks, and draws mainly on the anthropology/sociology traditions of the past 15 years or so. Here social networks are connections between individuals, groups and institutions, through which many things may pass back and forth, including necessarily information: communication is an integral part of the connectedness of networks. Networks are general phenomena and may serve conservatory or innovatory purposes. Social network analysis evolved mainly as a reponse to structural-functionalism: the latter focused on how individuals, groups and institutions fit into a social system, while the former reacts by examining how individuals (mainly), groups and institutions form connections to maximize their self-interests (or fail to maximize them), with exchange of services of various kinds. Individuals are the main units of analysis, apparently because kinship groups, communities, elites, secret societies, etc. have been the main center of attention and because, until recently, analytic techniques have not been developed for groups and institutions. A major contrast, in social network analysis, has been between traditional societies where people live in face-to-face, low-technology, intense, closed and dense relationships and urban societies where people live in high-technology, ramified, open and scattered networks: from small societies to global society.

The third section applies some of the social network analysis. In the first part, some interesting research on the 'small world' problem, the search for jobs through information contacts, and the relations of governments to communities in trying to achieve social change is mentioned, which introduces issues around the interface between individuals and institutions. In the second part, more focused research on social networks in education is reviewed, in this case dealing explicitly with attempts of the Federal Government in the United States to find alternative ways of encouraging innovations among pratitioners, i.e., teachers and administrators, and in communities, especially low-income or otherwise discriminated communities. This literature applies both sense (c), general informal social networks, and sense (d), social change networks, and to some extent sense (e), general institutional mobilization. That is, 'network' is used both as a general term and as a term referring especially to social change movements and a general state of social uncertainty. Thus, although the Government is 'the system', it also wants to maintain flexibility in assisting social change to come about.

The fourth section turns to institutions. The first part rather briefly looks at intra-organizational analysis with respect to communication within the organization. Communication analysis is a relatively new general technique, in the examination of both maintenance, production and innovation processes. Communication problems are usually seen as being internal problems. Informal social networks are recognized as well as formal channels. The second part looks at inter-organizational relations, where the unit of analysis is organizations as well as individuals and units or departments. Here, there is a strongly-developing stress on sense (e), as already mentioned. That is, organizations in the modern world are seen as being required to form network rather than bureaucratic patterns in order to cope successfully with uncertain conditions. Corporations, by becoming multi-national, are seen as adapting well, while bureaucracies, even in the center-periphery model, are seen as failing. The relatively restricted sense (b), general inter-institutional resource-sharing, occurs little here.

Because issues of innovation and social change, partial or total, episodic or continuous, stand behind much of the analysis of networks, a section is included on diffusion and exchange of new ideas, theories, practices, etc. There has been substantial work on 'invisible colleges' of researchers, as well as on the chains of diffusion of rumors, voting decisions, absorption of mass media messages, adoptions of drugs by physicians, as well as of other novelties.

An important omission in the bibliography, to which attention should be drawn, is the almost complete absence of references to mass media (radio, television, newspapers, magazines, etc.) as both technical networks and formal information delivery systems/networks to a wide range of people, far wider, of course, than the range served by library/information networks and systems.

There are two sections on cases, some 50 in education and some 20 outside. Cases of 'networks' in sense (a) are included in the education but not the other section. Sense (c), ordinary, informal social networks, is not included for obvious reasons. It is in senses (b), inter-organizational resource-sharing, (d), social change (especially), and (e), general institutional mobilization that most network cases can be analyzed. However, it is fair to say that we have not developed an integrated analysis at this point. Some general comments about why this is so follow:

(a) documentation varies from full evaluations by outside bodies, through case histories to brief descriptions, pamphlets, and products such as newsletters, to personal correspondence;

(b) this variation reflects the wide range of types of network, from expensive/institutionally-sponsored/outside-evaluated to no direct cost/interpersonally-related/membership-evaluated (simply by continuing the arrangement);

(c) the relative paucity of cases with reasonable documentation at the national/regional/international levels, with the main exception of library/information networks/systems and U.S. Government-sponsored networks, has led to inclusion of other cases (i) at the sub-national regional and local levels, (ii) outside education in other sectors that have developed networks earlier than education has and thus offer more documentation;

(d) even so, there is not enough information to develop a matrix or other more analytic form, with confidence;

(e) but, in respect of certain elements in networks, such as variations in institutional affiliations or facilitator/hub characteristics, some analysis can be done.

Finally, it is worth noting that the bibliography is oriented to modern Western societies. Obviously, this is not because informal and formal information networks fail to exist in developing countries but because, particularly on the analytic side, there is little or no literature; on the case side, there are several examples, particularly those sponsored by Unesco.

Unesco and Information

Two key features of Unesco that have to be kept in mind as we conduct this analysis are:

(a) it is an international bureaucracy of considerable complexity, with a central secretariat and decentralized offices and specialized bureaus;

(b) its mission is one of creating formal links of cooperation with Member governments towards a specific objective and of coordinating the resulting activities.

Penna (1976) reviews five basic trends in the last 30 years of Unesco's assistance to member states in documentation, library and archive (DLA) services: determining with greater precision the principles and structure of DLA services, especially with the development of NATIS and UNISIST in the 1970's; internationalizing the services in collaboration with the profession; developing standardized techniques and procedures for acquisition, administration and handling documents; training professionals; and promoting books.

This long-standing DLA tradition at Unesco, including the recent development of the technologies of computers and telecommunications, puts Unesco mainly in the library/information science tradition when it comes to information. That is, information is seen as documents or other formal materials in some medium subject to inter-governmental and inter-institutional transfer. Unesco provides services to or coordinates services among member governments, including offering training and developing the sophisticated modern computerized systems/networks that hold such promise for the future.

There is a newer thrust to Unesco's program. This consists of innovation-related documentation networks imbedded in broader networking arrangements in the form of technical cooperation between developing countries

(TCDC). This thrust is a much more flexible one and demands organization responsive to current developments. Here, Unesco puts itself among those who recognize the continually changing nature of society and the need for more responsive forms of organization to deal with the changes more successfully.

Whereas the latter program is innovation-related, the former more general program is not explicitly given a particular thrust except insofar as basic raw data, basic bibliographic data and basic current awareness data are seen as necessary and important.

In education, we can illustrate through the example of the International Bureau of Education, a decentralized specialized agency concerned with educational information. Since 1971, the International Bureau of Education's goal has been to work vigorously towards establishing a world system for the exchange of educational information. In so doing it has been developing networks of existing institutions concerned with information flows in education, at both international and national levels. The major network components are national centers dealing with educational documentation, research and information (Unesco, IBE, Information Networks ..... 1977).

The 36th Session of the International Conference on Education in 1977 recommended that Unesco should "play a leadership role and should undertake the specific task of developing a plan for a world information network in education," (Unesco, IBE, Final Report ... 1977).

The networking approach was defined as one "by which existing or new regional information programmes are interconnected and linked into a world-wide network". IBE recognizes that such a network tends to have restrictive qualities: the codification of experience by official bodies in traditional form, the building of international programs from the top down to a limited group of national and international administrators as users of the information, etc.

At the same time, the special component of IBE, the International Education Reporting Service (IERS), which was established in 1974, has focused on the exchange of information about change, such as reforms, actual cases of innovations and suggestive policy-oriented research. The concept of change locates IERS, together with the innovation-oriented regional networks at Unesco Regional Offices (of which APEID, authorized in 1972 and started after appropriate planning in 1974, is the first example), away from the main line of information centers for codified information. Furthermore, APEID and succeeding networks are explicitly based on the principle of resource-sharing: "The relationship between the participating Member States is not one of donors and beneficiaries but based on reciprocity, mutual learning and self-reliance" (Anon., "The Asian Programme ....", 1977).

Thus, whereas the main thrust of IBE's program is the development of a world information network in education, which may well have restrictive features common to formal information systems conceived as documentation systems joined together in a network, a second thrust is the development of information networks conceived as documentation/technical assistance networks for innovation, in which research results, results of cases of innovations and of general reforms are made available and exchanged. Here information does not stand by itself but is part of action.

The Five Analytic Sections of the Bibliography: A Review

(a) Information, Library and Computer Networks/Systems (I)

One professional field in which the concept of 'networks' has been used and developed for some years, and for which there is a substantial literature, is that of library and information science.

Librarians and, more recently, information scientists, together represent a strong 'information' tradition with secure institutional bases. Both in themselves and in the absence of challenges from other formal conveyers of information, they are able to develop their documentary tradition more or less on their own terms. No one is 'against' information, even if 'information' is not defined.

The other main institutionalized conveyer of information is the news media, which concentrate on developing stories as information, these being seen in the library tradition as 'fugitive material' except insofar as newspapers are collected as data for history.

Libraries have traditionally defined themselves as repositories of information whose value is not transitory but long-lasting. They tend not to like 'fugitive' material, which it is expected will be covered in the mass media, professional newsletters and other transitory publications. Likewise, they see the media as covering 'news' as it happens, while they cull those documented aspects of newsworthy (or not newsworthy) events that have lasting impact. This definition is a source of rigidification in service-definition analogous to that of bureaucracies compared with less formalized institutions and groups. It also provides a selection mechanism for material to be acquired and kept.

We start with this substantive field because it is of direct interest to Unesco. In terms of our five analytic senses, it tends to use the first two senses. Behind each of these two senses is a general concept, in which nodes exist with interconnections between them.

In the first sense, the nodes and connections are simply physical; in the second they are inter-institutional. It is implicit in the first sense and explicit in the second that 'resources' of some kind are being conserved. Interconnectedness is related to mutual support.

The second sense of 'network' is more general, while the first is associated with newer developments in computers and telecommunications, as media, for storage/retrieval and for distance-reduction.

Although we have suggested two analytic meanings here, the library/information science literature shows continuing confusion about the meaning of the term 'network':

> "To interpret the word networking as referring only to an automated or computer-based operation is misleading. To quote a well-worn phrase, networking means different things to different people. There are many different types of networks in existence today--different in terms of the services they provide, the people they serve, and the areas they cover. Some use the mails, some telephone, and others (or perhaps the same) use delivery trucks and teletype. They may not make use of any automated or computer-based techniques, and yet they, too, refer to their operations as networking."
>
> (Trezza, 1977)

The terms 'network' and 'system', as already mentioned, are used rather interchangeably in the literature. The two terms are not, apparently, seen as opposed but rather as emphasizing different aspects of the same issue. The network side emphasizes patterns of interconnections between nodes, while the system side emphasizes the internal processing, switching and other operations on the material flowing through.

It is thus clear that we are dealing with a formal inter-institutional arrangement which creates a new pattern and entails various management problems that may be approached through systems analysis.

Overall, library/information systems/networks can be seen as relatively recent attempts to introduce new systems to share bibliographic resources and provide improved services to users. Much attention is given to hardware, management issues, planning and implementation, formal legal and political considerations, but actually rather little to users.

Whereas social networks are informal, and in the social change sense exist or are set up as alternatives and challengers to formal systems, particularly governments, information networks are formal, with legal agreements, charters, organizational and consequent management considerations, etc. While social networks are inter-personal, library networks are inter-institutional, although presumably intended for the ultimate benefit of individual as well as institutional users.

The extremely varied kinds of network relations have been developed in this tradition to achieve economies of scale and to take advantage of new technologies. Management, planning and other modern larger-scale approaches have been adopted, especially because the new systems/networks, although expected to be cost-saving in the long run, require a large initial capital outlay in most cases.

One thrust for these arrangements is, then, that economies of scale can be realized in the face of increased information, greater numbers of distant users, and failure of budgets to keep pace with single-unit costs. The face-to-face library/information center is being replaced by a media-dependent set of interlinked centers. In this sense, documentation networks' development mirrors social networks' development.

The second thrust is that the new technologies of computers and telecommunications in themselves suggest novel modes of moving and storing mainly bibliographical data but also raw data, management data, etc.

Cooperative networks more generally entail interconnectedness for resource-sharing. This applies both to libraries, the more recent information services and other types of information/documentation services. Because libraries have very clearly defined procedures, cooperative activities, whether or not assisted by computers, deal with the fairly standardized and labor-intensive selection/acquisition/processing/cataloging/inventorying procedures; abstracting/indexing for reference; and interinstitutional exchanges of material. Circulation, processing of serials, and fiscal control are less subject to cooperative arrangements and computer processing.

It is intended to make all documentation available in some form to consortia member institutions while avoiding unnecessary duplication; in extending the consortia, it is necessary to build up new library centers and staff them appropriately so that they may participate, whether to input, take out, or do both. In cataloging, it is important to share the work and also use compatible classification schemes; in abstracting, it is important to chose a language understandable to the user; in exchanging material, speed, relevance, reliability, etc. are important, so long as costs are controlled.

Physical networks involved transmission plus, in some cases, notably computers, storage in a new medium. Networks of interlinked nodes can take several shapes, for example: star, net, ring, distributed control, fully connected. These shapes or topologies imply various degrees of hierarchy and centralized control. Any system/network makes basic decisions about hierarchy and control in adopting a particular form. Distributed processing networks hold the most promise for complete decentralization, while star networks imply most centralized control.

Network shapes are dictated to some extent by availability of hardware. (For example, the new generation of mini-computers has decentralizing implications.) Whatever the network shape, general technical issues include switching capacity and the compatibility of systems to be interconnected.

But there is no doubt but that through computers powerful new documentation approaches, such as selective dissemination of information and on-line retrieval, can be offered, within the bibliographic limits of various approaches developed. 'Current awareness' is particularly important in view of attention to new developments, innovations and fast social change.

Although in several ways it belongs in the diffusion section, mention should be made here of the interesting development of computer conferencing as a device for dealing through telecommunications and computers with distance problems of conferences as well as interactional problems: conferences can be rendered asynchronous through the storage feature of computers and people at vast distances can be brought together. Participants may either stay in their usual location or proceed to one or more centers. For conferencing, they can enter information and receive it, modify it and replace it, in an asynchronous fashion: locations can be diverse and time staggered. The most sophisticated version is EIES (Hiltz, Turoff and colleagues). For diffusion or development of specialty networks, the National Science Foundation is presently conducting experiments with EIES.

Many writers consider that technical issues can be taken care of fairly easily, although switching, compatibility of systems, standardization of language, etc., are not simple, especially in the face of multiple native languages; they think that the main issues are economic, political and social. Financial/political decisions do seem more important, including decisions about what sort of network structure and shape would be appropriate for the institution, government or international body. We would agree that major attention has gone into internal-to-the system issues, as it has in other fields, and that some important issues have been neglected. Before we turn to these, we would refer on to several of the approaches on inter-institutional arrangements in section four. There, we find an important analytic tradition arguing that potential innovations in a time of rapid social change meet a dynamically conservative tradition in institutions and are best conveyed by a specifically reduced-hierarchy network arrangement. We may expect that, in library/information science itself, as well as in the broader political world in which libraries and information centers sit, there exist dynamically conservative resisters as well as those trying to bring about new conceptions of information networking.

Libraries are not incompatible with bureaucracies. Both can have dynamically conservative stances. Libraries are in the business of conserving documents and acting as repositories. Thus, their tradition is not one of keeping in continuous touch with new developments--this is done by the media and the recently-developed information centers. Their services are not particularly geared to a continuously-changing world. Although open to the public or to a special group, they are not necessarily easy of access in terms of their products and services. Their relative insulation may be pointed out through the following critique.

Fife (1977) has stated that libraries tend to be passive in terms of reaching their users: the user is almost always required to go to the library to find out what is available. "ERIC and other information systems ... have not seen, as part of their responsibilities, the training of users .... This may be too much to expect of any information system." Bonnefoi (1977) found in his review of user studies in the library/information science tradition that there has been very little systematic investigation of users' needs and actual use of such services, nor have evaluation criteria been developed in any systematic way for evaluation purposes. UNISIST, while recognizing three types of information movement (informal sources, more formal sources and data sources produced in tabular formats), and while quoting Price to the effect that 80% of research input among scientists comes through informal networks (1971, Chapter 3), does not seem to have devoted effort to investigating informal networks and how they could best be interfaced with formal systems, but rather to have concentrated on development of the sophisticated and imaginative large scale network/system-enhancing efforts currently in progress.

Apart from user access issues, Fife (1977) has also pointed out, with specific reference to the process of generating research information and disseminating it in a timely way, that "fugitive literature makes up a majority of the literature produced on education." This is why ERIC was developed; CARIS in agriculture is another formal network system for a similar purpose. The more informal network developed by Pritchard (1977) is an alternative approach, using inter-personal networks and exchanging information through low-technology media. In life, generally, most important information is 'fugitive'.

The issue of 'user access' surfaces when there is an inner group in a social service institution providing a service to outsiders and questions of openness and satisfaction of outsiders' needs arise. The 'user access' issue is a particular case of the general issue of ready or restricted availability of a service to people who need it. It is always an issue to what extent scope of material and access of users will be widened or narrowed. UNISIST's Study Report (1971) urged formal systems/networks as a means of widening access; but the 36th International Conference on Education and the EPP Symposium both recognized the restrictive qualities of the systems. It is always an issue to what extent the material put in and the users/members will be screened and selected. Information systems/networks have been criticized for putting too much poor material in. Apart from this, questions have been raised about the extent to which, even with keyword treatment, computer-based systems can provide a sufficiently trustworthy precis of material that it convinces users to cover the material in its entirety.

At this point, it is worth developing a key idea behind this bibliography: the extent to which informal networks play an almost infrastructure role to formal information systems. The information that people exchange in informal networks is sought and given on the basis that it is parsimonious and trustworthy in relation to the needs of the receiver. We can introduce the idea with two quotations:

> "The immediate stimulus to my interest in how scientists discover relevant research was a questionnaire I received from a graduate student in library science. She asked me how frequently I used various information retrieval facilities in my research. A number of them I hadn't known existed, and there were none that I relied on."
>
> (Murray, 1978)

> "Governments and international bodies while accepting (in some cases) the importance of the personal communication subsystem have as yet rarely taken practical steps, based on the importance of the interaction between the formal and informal systems in the total information system. Their

> main response to the information problem has been to develop, or propose, major computerized abstracting systems, library cooperation mechanisms and the like, while hoping the 'informal' subsystem will take care of itself.
>
> In cost/effectiveness terms, however, this is not enough because the formal subsystem is only part of a larger system..."
>
> (Cooney and Allen, 1974)

The basic fact here is that information users cannot operate without using the informal networks through which trusted and relevant information is shared. Formal systems/networks presuppose such networks. Cooney and Allen call the persons who, in their context of technology-developing companies and other related institutions, receive information from a wide variety of sources external to their organization and from sources inside it and act as key information sources for colleagues, 'technological gatekeepers'. They point out that the diffusion literature has discovered that between, say, mass media, and individuals there exist one or more people through whom the information goes before it is accepted, so that, in general, the interpersonal networks through which information flows are crucial in making information spread and gain acceptance. The point about interpersonal networks seems to be able to be generalized.

Why does the interpersonal network continue to operate? It seems that the network's key members perform a selection and shaping function for the membership that no formal, including computerized, service has been able to provide. It also probably performs a normative function, in the sense that information selection/shaping will tend to validate the members' values and needs. This has been demonstrated by the anthropologists (e.g., Boissevain, 1974) in terms of community and kinship networks, and certainly operates in organizational contexts too. Personal influence, as we shall see subsequently, is also crucial.

It therefore becomes appropriate to move on to the literature on social network analysis. Further, we are suggesting that analysis of 'dissemination' can be applied to analysis of 'users', to whom information is, in a different sense, being diffused. But in the diffusion process, formal systems/networks need intermediaries. Even with a few user-helpers in libraries/information centers, assisting at the interface, it is probable that people would also rely on informal networks.*

One interesting development here in the library/information science literature is a focus on 'information brokers.' These are individuals and institutions that, on demand, seek to answer questions using all sources available. It would be worth examining them further.

(b) Social Networks: General (II)

In the social sciences, social network theory, theory about informal social networks, in analytic sense (c), has developed to an appreciable extent in the past ten years or so. There has been considerable movement from using 'network' in a metaphorical sense to using it in an analytic way, although the sociometric tradition (Moreno, 1953) has been in existence for some time.

As with physical networks, the basic idea is that of a set of nodes - which can be persons, groups, institutions, etc. - which have links or linkages between them. The developing analytic tools are related mainly to topology and directed graph theory. Here, it is patterns of interrelationships that are of importance. In this sense, network theory stands in contrast to causal theories. It is interested in both the presence and absence of ties, equally. It examines both structural and interactional properties.

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*I in fact did so in preparing this bibliography. I found less than 5% of my usable citations through strict library searches and SDI printouts. I did go to libraries but in search of material already recommended, which led me to more individuals and more material.

Structural properties of networks that exist and are mobilized under certain conditions for certain purposes include size, ramification/density, reachability, range, centrality and clusters; interactional properties include single- and multiple-strandedness, directional flow and frequency/ duration.

Whereas structural-functionalism examines how parts fit or fail to fit into a whole social system, network analysis reacts by examining how individual nodes try to maximize their separate interests by exchange with others, although each node has different interests and will change in its networks over time.

Although the 'unit of analysis' may be individuals, groups and institutions, anthropology and sociology, for historical reasons, have focused on individuals and their social networks. Anthropologists were interested in kinship, communities and the move of individuals to urban areas; sociologists were interested in modern urban communities and the connections within and between them. Therefore, although it was recognized that every individual is connected ultimately to every other individual, 'partial networks', with first order, second order, etc. zones radiating out from the individual, were first examined.

An additional reason for examining small networks was that there were not any available techniques for analyzing large topologies. However, these have been developed more recently, as we shall see in the section on organizations.

Once the idea of links and interconnectedness is established, it is possible to take another perspective and examine the number of steps it takes an individual to go through networks to get something desired. Not only is information, among other resources, exchanged, it is actively sought out. We shall return to this in the section on applications (III).

Network analysis has been particularly interested in the movement from dense structures into which everyone fits in multiple-stranded linkages, that is from traditional societies, to open, ramified, greater range, more single-stranded networks, that is, to modern urban societies, in which there is an important dependence on modern technologies to make the connection.

This general analysis of networks has no bias towards innovation or conservation but may consider all networks equally. Clearly, the shifting groupings and coalitions in network form have some normative function in terms of which people will feel they belong, can trust the membership, can give and take, exercise or respond to power, etc. It is possible to develop choice-constraint models here, given the patterns and limited alternatives and resources, of benefits and costs of options, choices and preferences. Thus, networks can be seen both as constraining (Fisher, 1977) and as permitting fluidity and movement (Boissevain, 1974).

Although there is no necessary bias towards a conservatory or innovatory function for networks, it is clear that, when networks are seen as shifting and changing, their form may be recognized as one appropriate to a rapidly-changing society. So it will not be surprising to find network forms espoused later, on an inter-institutional as well as inter-personal basis, as forms appropriate to contemporary conditions - analytic senses (d), social change movements, and (e), general institutional mobilization.

Networks can also be seen, as they have by authors such as Mullins (1973), as one patterned stage in a series of stages through which movements come together and cohere. Specifically, he suggests, in terms of the development of subject specialties, a movement from normal, relatively-isolated, to network and then cluster and finally specialty forms. Here, we see one idea of progression from relative isolation to some cohesion when ideas are in process of developing and a movement is under way.

A final point to be made is that, in contrast to the theme of nodes with zones moving out from face-to-face relationships to secondary relations, etc., with or without modern media as channels, there is a theme which presupposes distance and assumes that connections need to be made. The very fact of distance means that media of communication, whether people-moving or information-moving, are essential. In terms of the development of patterned stages, here we find that relatively isolated individuals need to be connected and that this can happen informally or through the enhancing intervention of some individual or group which facilitates these connections. The coherence of movements can thus be assisted, as they come and go, by deliberate intervention. Here the question is what kinds of intervention are appropriate and whether it should be kept informal or whether formal institutions can enter the picture. This becomes particularly important when we consider applications to education in a context of social change.

(c) Social Networks: Applied (III)

It is fair to say that social network theorists have not provided many useful results for network practitioners: here, too, there tends to be a gap between research and practice. However, one or two meetings have recently been organized to bring together theorists and practitioners, recognizing the importance of dialogue and the earliness of development of each; and the International Network for Social Network Analysis includes some practitioners.

Some brief suggestive ideas will be offered here.

First is the 'small world' problem research. Milgram (e.g., 1967) and associates have examined how long a chain of personal contacts would be necessary to connect arbitrarily chosen pairs of individuals in the 200m population of the United States, irrespective of class, sex and race. They found that, using a procedure of forwarding a booklet with instructions to move it on through strong and weak personal ties to a named target person it took 2 to 10 steps to complete the chains, which were completed in 12 to 33% of cases, averaging between five and eight. This is why strangers who meet and find they have an acquaintance in common say 'it's a small world'. The small number of steps is very surprising: it derives from the geometric nature of the progression and the fact that each step is independent of the previous one. Yet it is clear that, if two people in two populations cannot make contact, no one can. There must always be bridging ties between groups; and few steps are needed.

Bernard and Killworth (1976, 1977) have more recently discovered that people do not know with any accuracy the extent of their informal social networks and do not remember accurately the extent of their communications with others.

Granovetter (1973, 1974) has argued that weak, as opposed to strong, ties permit greater access to information, since the information can then come from many more sources; strong dense ties create more impermeable boundaries. Thus job information, community assistance information, and specifically diffusion information, are most effective when relying on weak ties and the bridges they provide, since they reach further. Thus, relatively low-energy networks seem to hold promise for more effective distribution.

In his study of job seeking information chains, the number of steps had to be zero (the prospective employer) or one intermediary if the linkage was to be effective in getting the job. Longer search chains were similar to the use of formal media (advertising) which did not create influence in getting the job. He argues (1973): "The usual dichotomy between 'formal' or mass procedures and diffusion through personal contacts may thus be invalid in some cases where, instead, the former may be seen as a limiting case of long diffusion chains. This is especially likely where information of instrumental significance is involved." This implies, in the case of libraries as formal diffusion sources, that short interpersonal chains are particularly useful for the acquisition of instrumentally useful information, e.g., citations and references and leads to new work, and reinforces the idea of the importance of social networks, gatekeepers, brokers, etc.

Murray Magill and Rankin (1978) also have found that 'good' information about academic jobs flows through short chains of personal contacts in the midst of a glut of possible formal information sources.

Thus, from one side, random or applied searches from one person to another, by a person looking for some information; from the other side, by some informal or formalized 'clearinghouse' such as a gatekeeper or newspaper - these involve networks, their links and chains, strong or weak, ramified and open or closed. Ideas here are not well developed but very suggestive for further work and analysis.

When we turn to the literature on social networks in education, we find ourselves dealing explicitly, for the most part, not with networks used in a general sense and from the point of view of individuals moving themselves or information or seeking others or some information through one or more steps, but networks in our analytic senses (d) and (e), social change movements and general mobilization, mainly (d). Here, 'networking' is seen as a feasible diffusion and change strategy. Networks bring together relatively isolated individuals and institutions and link them in a relatively loose, non-hierarchical manner, inspire good feelings and solidarity, etc. A key issue is then the power of networks in the face of governments and the ability of governments, or any other formal organization, to intervene to enhance their operation without adversely affecting them.

The United States Government became interested in social networks as a means of bringing about social change after the failure of social action programs in the 1960's. These programs, in Schon's analysis, used the center-periphery model (see p.40 below) for diffusion and failed. In their short analysis of networking structures, strategies and characteristics, Cohen and Lorentz (1977) are explicit about the resource-saving and consequently greater cost-effectiveness of networks as part of Federal government programs and projects. The basic idea is that by tapping into social movements and intervening to assist them get organized, the government (and any organization, national or international) can bring about needed social changes in an effective way.

Several authors suggest role elements that can be played in this type of network. Schon (1971), who is more general and covers possible networks in organizations, between organizations and in overall systems, suggests: systems negotiating (e.g., ombudsman, tolkach), 'underground' managing (over jurisdictional lines), manoeuvering (to get institutions to cut through institutional lines), brokering, mediating, diffusing, referring, evaluating, and managing official networks. Judge (1977) adds value/goal generating/maintaining, researching, interpreting, system defining, informing, involving, looking out, dealing with emergencies and strategy/policy-formulating.

These can be seen to be elements of activities in networks of a broader generality than the ones considered in this section.

When these later types of networks come to be considered, one definition suggests that each unit will perform these activities as necessary: "The network is not coordinated by anybody: the participating bodies coordinate themselves so that one may speak of 'auto-coordination' rather than coordination. Similarly, the network as a whole is not 'directed' or 'controlled' by any body, rather it is 'self-directing' and self-adapting" (Judge, 1972). Such versions of networks certainly exist.

When the facilitation or enhancement of networks is considered, and among many networks in any case, a facilitator/coordinator individual or group (the latter called by Goodlad 'the hub', and by Dalin and Kadushin, the core) is found. Here the key issue is the degree of centrality that the facilitator/coordinator/hub will take. Generally, some degree of coordination of functions is considered appropriate, but it should be the minimum necessary. In one of our cases, an inter-institutional networking effort is stalled because the membership rightly consider that the coordinator wants to make the network something that he controls.

Eichen (1977) suggest that networks need both an innovative champion with a conceptualization of 'network' as a form through which innovation may be conducted and a coordinator/facilitator, who will perform the types of roles already mentioned. Cohen and Lorentz (1977) describe coordinator/facilitator skills as follows: "Basically the role of the coordinator is to bring and keep together people of different talents, to help them grow and develop, to be sensitive to new problem areas that need to be addressed by the network, and to be the scorekeeper. Coordinators, then, need to be group leaders, trainers, bridge-builders (within the network and between the network and outside institutions), and managers. There is room in a network for a variety of coordinators ... To carry out functions as a generalist the coordinator must be able to understand the work of several of the specialists." Clearly, there is no formal training for this type of skill, but the example of the informal technological gatekeeper (above) or formal manager (see section IV) as well as actual examples of coordinators in informal social networks, show that the roles can be performed successfully.

Parker (1977), reviewing all the cases of networks he examined, considered the following network properties essential: being an alternative to established systems; holding a sense of shared purpose; sharing information and psychological support; using a facilitator/coordinator; and relying on voluntary participation and egalitarian treatment. He found that networks vary in terms of: specific and general purposes; invention, adaptation and replication; 'altruistic' and 'selfish' motives; inclusive and exclusive admission; internal and external financing; geographical spread; and informal and formal structures.

The variations suggested by Parker can be commented on further. Sarason and others (1977) have laid great stress on combining individuals from multiple home bases and from unlike positions in their institutions. Cross-disciplinarity and cross-status flexibility is thereby achieved. It is assumed that social problems and innovations benefit from a variety of participants. Pritchard too (1977) sought out network members, not by position, but by active interest and from a variety of disciplines and positions in the research/practitioner spectrum. The development of specialties, on the other hand, or of single issue movements more generally, will lack this feature to a great extent.

The reasons for people joining networks, which may be considered by participants 'selfish' or 'altruistic', are summarized by Parker (1977):

1. information and resources received from immediate quid pro quo exchanges;
2. information (and perhaps resources) gained in an unpredetermined manner;
3. psychological support received in an unpredetermined manner;
4. positive feelings derived from being part of a special group or 'family';
5. the opportunity to help others share and learn.

The issue of admission is one about which there are arguments. On the one hand, if the participants are to trust each other, some screening seems important; on the other, if openness to new ideas, people and practices is to be maintained, appropriate structural permeability must be possible. Strong ties must not supplant or control weaker ties; otherwise cliques and other relatively impermeable informal or formal organization results.

The geographical spread variable is of particular interest to Unesco. We find that those authors more familiar with local/regional networks, drawing on the idea of centers and zones radiating from the centers, place considerable emphasis on face-to-face meetings. Those interested in linking far-distant individuals, groups and institutions, not being able to depend on meetings, tend to substitute shaped, useful and trustworthy information, through various forms of media, to link members up. Miles' (1975) definition applies here: "A dispersed structure permitting low-energy access to trusted competence. Appropriate information, energy and other resources can easily be located from physically dispersed nodes to solve local problems." Personal contacts are attempted around this core, often through travel by the coordinator. But transmission media are mainly relied on, usually in the most parsimonious form for resource-sharing, especially in the non-hierarchical network. Hubs and centers are often associated with interventions by governments or other organizations, get more financial resources, and can more easily arrange personal meetings.

The mere sharing of information, involving low-energy access, is often considered insufficient to develop real changes. Apprenticeship, skills-learning and other forms of high-energy involvement are essential. Schon, Goodlad, and others are agreed on this. Dalin (1977) mentions the following communication strategies and techniques that can be facilitated in networks: peer-learning through meetings, a process orientation using discussions to maximize transfer, implementation studies, and personalized information systems through which members contribute short summaries of their work. Pritchard's network performed this last function and formal systems do it through 'current awareness' services. So a two-level network set may be tentatively suggested: information-sharing and morale boosting plus training and apprenticeship at a more intense level. This issue is of particular importance for distance-connecting networks and should be examined much more closely.

The variable of invention, adaptation and replication suggests diffusion concerns and brings us to the later discussion of diffusion models (Section V) and alternative versions of structures appropriate for different kinds of dissemination. The issue of internal and external financing is similarly related. In the cases, we find that financial backing varies from essentially a straight barter situation to a multi-million dollar operation, this variation being connected to the degree of government involvement and the predominance of the to-be-explained center-periphery model of diffusion. Formal and informal structures indicate both stages of development and outside institution involvement. Whereas most network organizers would not consider formal arrangements in the informal egalitarian spirit of networking, the simple example of library networks as an inter-institutional resource-conserving system shows that the term is still applicable. Whatever the ideology of egalitarianism, actual examples have to be examined for degree of hierarchy and its effect.

In somewhat the same way as Mullins (1973) with developing specialties in science - stages of 'normal', network, cluster and specialty communication patterns - Parker (1977) also suggests a series of stages for network development, including decline: (a) isolated innovators and problem solvers become (b) informal contact networks, which may then become (c) deliberate informal networks; some of these may become or be created as (d) formal networks, which may then become (e) institutionalized, with (f) the spirit finally being dissipated, and (g) new networks possibly emerging from the decay.

Miles (1978), reviewing the networking papers commissioned by N.I.E., focuses on deliberate efforts to create or strengthen networks. He considers that these efforts are possible and suggests five general variables that will influence network strategies: (a) the general 'frame' within which the problem of educational change is being viewed; (b) the implicit view being held of the educational system; (c) the type and scale of educational change contemplated; (d) the general type of network being considered; and (e) the anticipated participants and their locations. His paper delineates and articulates to the greatest extent we have yet seen the variations in several dimensions of deliberately-created networks in education.

Despite recognition of the importance of social networks, their power in the face of governments has been questioned. Peterson (1977), for example, arguing that group theory and network theory overlap, applied a political science critique of group theory to networks:

> "If networks are sponsored by the state, they may simply retard the process of social change. If networks must operate within the confines of the larger, more rigid stratification system of the society, then they cannot fundamentally affect that structure. And if incentives must be given to individuals to induce their contributions to networks, then those with the most resources will find networking the easiest. Networking is thus not a viable social change strategy."

The critique by Peterson can be countered by the Schon-type claim that formal organizations seem to be the precipitates of social movements, so that movements for social change in network form are worth encouraging since some of them, in the long run, will be very important.

Schon (1977) himself also adds a critique about networks. Modern culture shows a strong faith in the formal service ethic, in terms of structure, organization and planning. This has important advantages over informal networks because it stresses "perspective, quality, equality, equity and responsiveness of services through the efforts of professional providers who deliver services under formal contract in conformity to standards of performance, for which they are publicly accountable ... and subject to external control."

Schon's own critique is important but tends to go against his own overall conception of current social conditions. For informal social networks also support the existence of systems against which social change networks mobilize: elites, old boy networks, secret societies, interlocking directorates, etc. The formal service ethic itself has brought forms of discrimination that are hard to eradicate precisely because of these networks that do not in fact espouse the ideology professed. Some of the innovations to be encouraged through networking may in fact be selected because they do promote various social equity goals.

We can conclude this section by referring back to the quotation of Miles at the beginning of this report. It was written by him with specific reference to the material in this section, although we have taken the liberty of generalizing it. What this suggests for Unesco's activity will be dealt with in the final section on recommendations.

(d) Networks Within and Between Organizations (IV)

Whatever the formal organization and whatever the formal means for moving information, especially in the form of documentation, between positions within the organization and between organizations, there will always be found informal social networks exchanging information in the form of rumor, reliable and useful information, corner-cutting information to make the job easier, as well as information designed to challenge some formal goal, process or procedure of the organization. Thus, any of the analytic senses of 'network' could be applied; but we shall focus on the last two, which may be particularly supported by the first - transmission media.

In schools and universities, there will be many informal networks of learners, teachers, administrators, and as appropriate, politicians, technicians, and parents. These, again, may be thought of as providing the informal infrastructure in which the formal school organization is set.

Much organizational analysis has confined itself to the organization as unit of analysis, without setting it in a larger context or, as some now call it, 'ecology'. Management studies and organizational development literature and practice have focused on internal relations and their improvement. We shall not review these studies here, since, from the point of view of network analysis, the most important studies are inter-organizational.

Some reference to intra-organizational communication can, however, be made. Allen's work (e.g., 1977) on information flow in technology laboratory communications has resulted, as already mentioned, in the identification of the 'technological gatekeeper'. Mintzberg's (1973) analysis of managers has reached a similar conclusion. The managers he studied performed ten roles in three groups: interpersonal, informational and decisional. The three informational sub-roles were monitoring (receiving and collecting information about the organization), disseminating (transmitting information from the ouside into the organization), and acting as spokesman (transmitting the organization's information into its environment). Through unique access to information and in terms of status, the manager could then play his four decisional roles. Thus, the manager is a gatekeeper with a formal position, obtaining and disseminating information by formal and informal means.

Richards (1975) has developed a program for the general analysis of communications in organizations; Goldhaber and others (1977) have developed an internal communication audit; Wigand (1977, forthcoming) has applied communication analysis to organization, for both maintenance production and innovation processes. This work is in its early stages and on the whole does not have specific recommendations for organizations, although it shows promise for the future.

Herbst's book (1976) on organizations serves to introduce also the inter-organizational analysis of authors such as Schon, Trist, Emery, Drucker, Judge and Michael. Herbst argues that organizations, in the face of a modern condition of rapid social change and uncertainty, must adopt a non-hierarchical form that gets away from bureaucracy, if they are to cope with their environment and thus provide management and workers with job satisfaction.

As in social network analysis, so in organizatinal analysis there has been a tendency to start with the organization as unit of analysis: here, internal relations are examined. Then, later, the organization and its direct relations (first order zone) to other organizations, called by Evan (1966) the organization-set, is examined. More recently, recognition of the further zones as forming an 'organizational ecology' leads to consideration of 'the field of these indirect interwoven relations which constitute the contextual, as distinct from transactional, environment' (Trist, 1977). Just as the primary work group is crucial for understanding a single organization, so social networks are crucial for understanding interorganizational relations. In them, interface relations require negotiation among relative equals, while intra- and inter-bureaucratic relations are based on superior-subordinate relations. The removal of hierarchies and their replacement by networking arrangements becomes a major theme of the literature. Center-periphery models in bureaucracies are inadequate for turning them into open and responsive 'learning systems' (Schon, 1971).

Careful programming, solving separate problems and reaching single objectives, especially by throwing increased resources at the problem, are the mark of technocratic bureaucracies and fail to help to deal with uncertainty and social change, in fact exacerbate the problem. External regulation from above is preferred to self-regulation of the parts, but will fail to be effective.

The solution proposed by Trist and colleagues is to strengthen social organization at the middle level rather than strengthening aggregate controls overall or single organizations (as the primary unit in industrial society). Only in this way can the hazards of inept bureaucratic control be avoided; the middle level organizations or associations regulate rather than control or produce; they appreciate rather than determine or operate. Here structure is at a minimum and culture joins with modern technologies, which can diffuse innovations with scope and speed. Thus, 'the individual ... is in process of becoming a network man rather than an organization man' (Trist, 1977). The core values here are those associated with organizational democracy, which, clearly, decreases hierarchies' power.

Another approach to current social change (see Judge, various citations, and the Johnson-Lenzes, 1978) is to see it in terms of complexity. It is argued that social variety is increasing and that it can either be narrowed through government centralization to the point of social or capitalist totalitarianism, or expanded by elaboration of and distribution of power and governance in accordance with Ashby's (1958, 1961) Law of Requisite Variety.

(e) Diffusion/Exchange of New Ideas, Practices, Theories, etc. (V)

We have discovered in this literature review that 'diffusion' is a term that naturally suggests itself in relation to informal and also formal networks of communication and information. The information/communication may serve a generally conservatory or normative function, as when rumors tend to support the values of those who transmit them among themselves; or it may be in the service of innovation. In this case, the innovatory values themselves become normative and focus normative activity for members.

Normally, people in their lives are living in more strongly- or weakly-tied networks and are diffusing information through them. Under some circumstances, people become partially or wholly involved in innovatory social networks and are engaged in them in a low-energy or high-energy fashion.

Behind the idea of networks stands an idea of diffusion; we are particularly interested in diffusion of innovation since at least two of our analytic senses and part of Unesco's information network activity in education concerns innovations rather than general documentation, which has no particular stance towards innovation.

Some of the applied social network analysis has suggested that short chains involving information movement are also more effective because they include a component of personal influence, whereas longer chains are more like formal systems such as mass media, libraries, information systems, which, even with selection devices such as classification and keywording, are not selective enough and do not also belong to a personal influence network. Influence implies rendering information useful through a winnowing/shaping/evaluating process, including withholding or omitting much that could be relevant.

Managers, key people in technology, politicians, opinion leaders, information brokers, are some examples of individuals who play formal or informal networking roles in the diffusion of information which is influential to those receiving it. Networking roles, as we have already seen, can be analyzed into types too in general terms, indicating the appropriate skills. Generally, these networking roles are bridging roles in the sense that they provide the only link between two nodes; two liaison people are necessary for a bridge to be created. Most diffusion studies naturally find that personal contacts are crucial; but the literature seems to be able to be divided into innovations that are large or radical and those that are incremental or hardly innovative at all.

The dominant diffusion analysis tradition, represented by Rogers (various citations), assumes that products or other innovations come fully formed and are diffused by a step-by-step process of communication. Schon (1971) argues that this model only works when the spread is of new products/techniques that presuppose a relatively stable technological system of which they are components, or, in other words, when there is a stable, relatively simple message that can be spread uniformly over a periphery. The agricultural extension agent is the classic example of this process and the Coleman, Katz and Menzel (1957, 1966) study of diffusion of a new drug is another.

Among the cases in education, PIP diffusion (Stearns and others,

1977) is a recent example, where the government takes a classic center-periphery stance. Even in this context, Sieber's (1977) critique of practices can be cited: "There is mounting evidence that the best way to serve the needs both of educators and of enlightened change is to adopt a highly flexible inter-personal approach with a bare minimum of role preconceptions and role props ... Yet ... virtually every program for educational innovation ... relies on ... a host of ... conventional managerial practices."

Schon has argued persuasively that innovations that require significant disruption of the entire technological-social system and the system of ideas related to it have to struggle with institutions that employ a dynamically conservative counter-strategy to prevent the innovations from taking hold. Most recently Benveniste (1977) has written about these strategies, without, however, examining the role of networks.

In the classic diffusion approach, the R D & D diffusion model generalizes the assumed top-down diffusion model and tries to apply it even though this is, on Schon's analysis, impossible in a dynamically-changing social context.

In the new networking model, center does not propose and dispose, form new policy and spread it to the periphery, in our case, communities, localities and practitioner groups; rather, it detects significant shifts at the periphery (communities, localities, practitioners), looks for new ideas coming into good currency, and derives themes by induction. Participation, control and autonomy can then be enhanced; actions are differentiated, continually-changing and connected.

Here, the key issue is not design of product but design of networks to respond to and diffuse innovations as they arise in as self-transforming a way as possible. The organization of networks demands both a new, flexible structure and development of new networking roles. The role elements have already been mentioned (above, p.28). Rather than a 'change agent', a 'learning agent' (individual, group or organization) is needed to make leaps in knowledge, synthesize theory and formulate new models while in the situation, through maintenance and development of projective models in some type of memory.

In a continually changing society that is no longer stable, a new model has to replace the normative diffusion theory and the center-periphery model. This is provided, on the one hand by the business system firm (developed from the single-product firm), which, by formal networking means, covers a service/product system, such as keeping people in clean clothes, nationally or internationally; and on the other hand, by the Movement of the 1960's and 1970's, which constituted a political opposition to the government and was successful through having no clearly established center, no stable, centrally established message, taking innovations and diffusing them as they arose and were responded to, and relying heavily on a telecommunications/travel infrastructure characteristic of the late twentieth century (Schon, 1971).

There are, then, two elements in the critique of classical diffusion theory and center-periphery diffusion organization. One is that most innovations are too disruptive to be diffused by the normal form of diffusion organizations used. The other, more general, one is that the social context of change and uncertainty is so pervasive that the center-periphery model is unsuitable for all innovation diffusion.

Any suitability it might have is limited to minor changes that are non-disruptive and, even so, seems to need the intervention of a 'change agent' operating in as informal a fashion as possible. Generally speaking these agents at the interface of formal systems with informal networks help diminish the relative impermeability of the organizations and help create confidence that the information or other assistance is trustworthy and useful.

Whether it is a matter of social change in a relatively-unchanging social structure (analytic sense (d)), or of general social change (analytic sense (e)), social networks seem to be an important if not essential form for diffusion. In terms of structural articulation, as suggested by Mullins (1973), they appear to be a form subsequent to 'normal' weakly-tied networks (in the general sense of the term) and prior to clique or other more impermeable forms of association. Paul (1978), looking at inter-institutional relations, analyzes forms of networks, with some degree of variation in centralization, complexity and interconnectedness; prior to these stand ad hoc inter-personal relations and subsequent to them stand official formal arrangements.

The stronger sense of 'network', related to social change and innovation diffusion, implies a certain pattern into which movements may develop and out of which they may move. The stages of network development referred to in the section on social networks in education (above, p. 33) are stages of network development in the strong sense.

Developing movements, when they reach the network stage, may choose to steer clear of institutional, especially government, affiliation, although they themselves may reach a stage of institutionalization. Several of our network cases in education have done this.

In other cases, governments or other sponsoring institutions may intervene to enhance networks, or may even deliberately try to create them. On the other hand, network facilitation may be achieved without governmental intervention. The Johnson-Lenzes (1978) have done some interesting work, using computers to facilitate communication among geographically-dispersed networks. They call these 'distributed processing networks', presumably after the physical network pattern they use. These process and make available information about members' interests, mental models, abilities, concerns, and values; and about the extent of the network itself to facilitate development of new relationships, since normally people do not know, with any accuracy, the extent of their networks, or what members have to offer as well as demand.

The argument that the social context for organizations is qualitatively different by reason of rapid social change, limitation of natural resources and the uncertainty these and like issues generate, suggests an application to libraries. Insofar as they engage in careful programming, pursuit of single ojectives by the application of large amounts of resources, and external regulation, they are likely to produce information systems of great beauty and indeed complexity, but ones that fail to deal with the multiple needs of 'users' as they shift over time, that is with the complexity of the context in which the users operate.

A more conservative approach would suggest that the innovation-related information services of libraries and their more end-result documentary services should be distinguished, the latter conforming to the classic diffusion model and the former implying the newer model. In this perspective, it remains true that it would be more appropriate to devote computer development to social change-relevant services, to delineate the groups of users and really reach them with information, in the formal sense but with informal interface assistants/coordinators, in a flexible and facilitative way.

The issue of 'users' or, in other words, people who live anyway in social networks and are potential social network members engaging in social change movements, demands serious attention. It is insufficient, for the purpose of serious change, unless it be change imposed through socialist or capitalist totalitarianism, to connect only government and international organization bureaucrats and policymakers through networks, even if those are informal. Since education takes place in communities, learners, community members generally, practitioners and local administrators, as appropriate, are the groups within which networks may be tapped for discovery, enhancement or creation of innovative change that is not minor but major and necessarily disruptive. Networks for social change that avoid governments tend to involve these groups.

Just as libraries may have vested interests in their empire, so researchers may have vested interests in the R D & D model or at least in the precedence of research. A few network projects, such as the Participatory Research Project (Correia, 1978) attempt to involve communities in their own research so as to help them find out about their problems, prospects and solutions to counter the research of outsiders.

It seems, at any rate, worth suggesting, in conclusion, that an examination of different types of network and their appropriateness for different types of diffusion, especially given the type of outside organization involved in creating or enhancing social networks or in developing formal systems, would be well worth while and that, as a specific focus for analysis, could produce some very suggestive results.

The Two Sections of Cases: A Review

'Network' and 'networking' have become popular terms in the last few years. The citations of cases in the bibliography are, for the most part, very recent. To some extent, the terms have been used since there is a fad for using them. Because of the multiple meanings of the terms already discussed and the tendency to use them as labels rather than in an analytic or even defined way, classifying them is rather difficult.

The difficulty is, as mentioned at the beginning of this report, increased by the relative lack and unevenness of documentation. No citations have been found, for example, on 'how to' organize, build up and maintain a formal cooperative library network. Networks devoted to movements for social change, when unrelated to sponsoring governments or other institutions, may produce material but not on how the network was built and developed. The cases described and analyzed by Parker and Claman (various citations) are useful here. When governments and other institutions, at some stage of the network-building, have a sponsoring relation to them, we find reports, even to the extent of external evaluations. Rather than describing the building up of networks, these reports tend to focus on products, outputs and other forms of achievement.

Since many networks are related to diffusion of innovation, it is possible to review them in these terms, particularly their relationship to governmental or other institutional bodies, the existence of (a) a classical or (b) a social mobilization diffusion model (Schon and colleagues), and the related degree of centralization or independence that the nodes display. Here, the physical medium that unites the members can tell us alot about the degree of egalitarianism in the network. The informality or formality of the network can also be examined in this context. Formal diffusion networks may take the classical diffusion approach, while some may be oriented by recognition of rapid social change and be designed accordingly. Informal networks, including informal interface linkages to formal systems, such as information brokers, technological gatekeepers, etc., may also presuppose either model.

The level of effort of those involved in the network is also an important variable. The low-energy-access networks may represent a weakly-tied stage of development of networks, act as a partial resource network in a more intensely-tied social movement network, or be a formal network system making available documentary information and disseminating it to users, hopefully on a low-energy basis. When there is a formal organization offering a service in cooperation with other institutions, the arrangement may be for internal-to-the-system resource-saving, or it may be oriented to users as individuals, institutions, etc., operating in a fast-changing world. In the former case, the classical diffusion model may well operate, while in the latter the social mobilization model is likely to be implicit.

In terms of the development of networks, of whatever type, both formal and informal networks may reach a degree of formalization which renders them inappropriately insulated from their social context, and we find instances of this in the cases. However, it would be considered by social change network proponents and by advocates of institutional mobilization in the face of rapid social change inappropriate for such rigidification to take place. Rather they would advocate the rise of networks to respond to issues and problems and their dissolution when the problems and issues were dealt with. Those performing roles in particular networks would be continually creating and letting go the networks considered appropriate under particular circumstances.

It is not appropriate in this review to go into a systematic analysis of the cases in terms of the variables suggested here as important for a thorough typology. Instead, we shall review the cases in an indicative way with a view towards highlighting some of the issues involved.

Many of the cases can be placed in the library/information network/system type. Some are full systems, while others are more modest attempts to generate reference materials, including directories of individuals and institutions that exist in a field and are in this sense linkable in networks.

Many of the cases can be placed in the social change network type and some have in fact been analyzed by Parker (1977) within that perspective. As already mentioned, some of these networks avoid government sponsorship or intervention, while others may be created or enhanced by intervention by government or some other sponsoring institution.

Analytic sense (c) of 'network', general informal social network, is naturally found little here. Analytic sense (e) of 'network', institutional mobilization in the face of continual social change and uncertainty, is one found implicit in many of the examples, but is probably explicit in only three. One is the production of the reference book Yearbook of World Problems and Human Potential (Union of International Associations and Mankind 2000, 1976), which is a mobilization reference book produced with the aid of computers and telecommunications drawing information and analysis from all over the globe. The second is the personal linkage system (Theobald, 1977) which is intended to link in a low-energy-access manner those with a common interest in the problems the world currently faces. The third is the United Nations University (Anon., "The United Nations University," 1975; Galtung, 1977; United Nations University, no date): here is proposed an international network of institutions developing task forces to deal with research and implementation on particular problems and issues, and including an information component as part of its services that should be worth examining further.

Returning to library/information networks/systems, ERIC is the main library-based information network with good documentation (Booth, 1975; Burchinal, 1971; ERIC Clearinghouse ..., 1975; Fry, 1972; among other citations). It involves a network of centers which collect materials and a more centralized set of centers which input them and produce output - reference materials, microfiche, etc. Like CARIS on an international basis in agriculture, ERIC on a national basis in education collects and disseminates mainly 'fugitive' material. It has many strengths. Its limitations are concentrated on means of finding documentation to input, screening material for quality, and failure to reach practitioners at the local level. Sieber (1976-77) writes: "The ERIC system and other resources do not reach the classroom teacher without the intermediary of extension agents with teaching backgrounds."

Unesco has an ambitious information/documentation development program involving telecommunications and computers as network media. In terms of cooperative arrangements, the input/output points are usually organized through Member governments' central or decentralized institutions. UNISIST is an overall program to guide technical, organizational and management aspects. NATIS is a major program for developing information services in Member countries. In the development field, DEVSIS is a major international network/system.

The Secretariat has developed some necessarily modest networking arrangements (e.g., Unesco, ALSED Directory ... , 1974) and is contemplating or developing others (e.g., Unterbrunner, 1978; Unesco, Adult Education Section, Consultation ... ,1977) in the field of education, where an attempt is made to link up individuals and institutions in a particular field, often with publication of a reference directory, thereby facilitating knowledge and permitting voluntary links. These efforts are related to the developing articulation of potential network members on a world-wide basis and seem to remain at the level of directory information, although they could be developed further within the organization.

The International Bureau of Education has, as already suggested, two thrusts to its work. The first is documentary and involves publication of newsletters and directories as well as the acquisition of materials, training, consultancy, etc. The second is innovation-related and focuses on the development of the International Education Reporting Service (IERS). This is related to the decentralized Regional Bureaus of Education and their developing or proposed plans for deliberately-created networks among regional Member countries for encouraging innovations (APEID, NEIDA, EIDPAS). The Regional Bureaus also offer documentary services (Vaska, 1978).

The development of IERS has been documented to some extent (Unesco, IBE, International Education Reporting Service ..., 1974; Unesco, IBE, Status of IERS ..., 1977). The orientation to innovation is crucial and the production of an awareness list and general newsletter is important. Given the resources allocated to the service, it is important not to have unreasonable expectations. A prior model, the ERIC system in the United States, is supported with far greater financial resources.

One interesting idea in relation to services such as IERS has been developed by ESCAP in the population field (ESCAP Secretariat, "The Challenge ....," 1975). Here a network of 'population correspondents' has been developed to increase the input/output interface of the formal network. The East-West Communications Institute has also developed an information network in population and family planning whose organizational features are of interest (East-West Communications Institute, 3 references; Radel, 1975, 1st reference).

The promise and organizational problems of the Regional Office innovation networks have been reviewed by Tinsman (1977). Here, information activities are imbedded in a broader resource-sharing and innovation-diffusing network. A major question is the extent to which intergovernmental formal information/assistance networks can reach the practitioners and communities in which education is taking place. Those who take the institutional mobilization approach - analytic sense (e) - would critique the organizational diffusion structure as too rigid in the circumstances and would propose other organized network structures. Related to this type of network is Proyecto Red (Bernede, 1977 ; Gutiérrez Reñon and others, 1977; Vaska, 1977), an inter-governmental sub-regional cooperative effort using a systems approach to define, analyze and assist technically, and implement programs for selected innovations in Central America. It includes a documentation component.

The APEID, NEIDA, EIDPAS and Proyecto Red programs involve narrowing the range of possible topics for innovation by a process of agreeing on which are the most important, at the governmental level. This is a useful screening device, comparable to the screening of material for ERIC and other systems and the screening of innovations in the National Diffusion Network (see below). In the first case, the goals are screened, in the second the documents, and in the third the innovations themselves. The latter two cases are general systems; the first case is focused by field. Focus by field also characterizes single issue movements, information centers covering a single or delimited field and single topic research networks, as compared with resource networks that crosscut topic boundaries deliberately or networks of people in similar positions with a range of problems.

Two of the information networking programs funded by USAID, the NFE Information Center (1977, 2 references; 1978) and the Information Center on Instructional Technology (1977) are essentially resource centers in sub-fields of education of interest to developing countries. Here, newsletters and mail responses to individual requests, with the assistance of SDI services, are provided. In these two programs, the network members are not interconnected but connected to a centralized hub and therefore dependent on it for the network to exist.

Non-government organizations are interesting in the context of diffusion and centralization. Reconceptualized by Judge and Skjelsbaek (1972) as 'transnational association networks', many of them display organizational decentralization of the network type. In this connection, the information services of the International Planned Parenthood Federation (Dennis, 1974; Forget, 1976, 2 references, 1978; Unesco, Information in Support of Population Activities, 1974) are worth examining. In the field of education, IMTEC (Dalin, 1976, 1977; IMTEC, 1978) adopts an explicit cooperative organizational form, with a hub to facilitate development and maintenance of various sub-networks.

The Central Bureau for Educational Visits and Exchanges (1977) is a decentralized governmental bureau that acts as broker for individuals and institutions interested in starting up network activities or otherwise being connected. This demonstrates that, in a government bureaucracy, the role of broker can be played within fairly broad limits. Among international organizations, the Development Education Exchange Service (1975) is another example of a far more cooperative effort than might otherwise be expected in the institutional setting.

NEXUS (1976) seems to perform an information brokering function through a single medium - the telephone. Questions are phoned in on a free-charge nationwide phone line and answers are prepared, immediately or with the assistance of a network of volunteer experts in a short time.

We have previously referred to research communities, especially in science and technology, and the literature on how new information is disseminated in them. Here, informal networks play an extremely important role, just as informal networks on new information do in communities. Several of our cases involve research and can briefly be covered together. Among the formal sytems, ERIC, IERS, etc., include progress and final reports on research. From the other side, the Participatory Research Project of the International Council for Adult Education (Correia, 1978) organizes research at the community level on the part of those involved. For individuals and institutions, the Unesco Institute for Education (Carelli, 1978) is developing a promising network, while the University of California at Berkeley (Pritchard, 1977) ran one for three years. The International Development Research Centre is developing a fairly closed but very interesting hub for the examination of educational research (IDRC, The Educational Research ..., 1977), which intends to consider substantive areas as well as the diffusion process. Resúmenes Analíticos en Educación is a low-cost product of a networking effort in Latin America to diffuse research rapidly.

In the United States, ERIC, already briefly described, is a research dissemination network/system. It is an alternative, more comprehensive and much more expensive means of diffusing information than, say, Resúmenes Analíticos or the Berkeley network, through which researchers can be more directly connected and with less access problems.

Other dissemination efforts are government-sponsored. They include that of diffusing project information packages of educational innovations to classrooms throughout the United States (Stearns et. al., 1977). This follows the classic diffusion model; of six innovations, the five most successful ones were the ones non-disruptive to the school system, being essentially new products that could be introduced without basic disturbance. The National Diffusion Network (Emrick, 1977; Hall and Alford, 1975; Neill, 1976; Parker, 1977) is well-documented and has done far better than it was expected to do. It even survived a gap of several months of Federal funding and was kept together by the enthusiasm of its members while they successfully lobbied with Congress for its restoration. It disseminates innovations that are more in the nature of services, such as teaching approaches, than products. On one side stand 'developer-demonstrators', whose innovations are screened by a government committee. Those approved are disseminated partly through individuals on the level of the States, known as 'facilitators', as either adoptions or adaptations. The developer-demonstrators are available for consultation by adopters, who like the wide range of innovations offered, and appreciate the developers as, for the most part, practitioners like themselves. Here, the connection of practitioners with practitioners who have innovated seems of particular importance in view of the frequently-expressed gap between research and practice. This model is well worth examining, both with regard to this aspect and with regard to how it fits with the classical and social change diffusion models. _Dissemination Networks: Information Resources for Education_ (forthcoming) provides details on a wide range of Federal dissemination programs in education.

Diffusion through inter-institutional connections is resource-saving for those who participate. The inter-institutional connections may be formal, or more informal, as with State-level facilitators in the National Diffusion Network. Smith (1977) and Rosenblatt (1976) present a further case study of an inter-institutional deliberately-created diffusion network, in the field of aesthetic education, discussing the process and problems involved.

The most interesting network at the interface of governments and social change movements is the Teachers' Center Exchange (Devaney, 1974, 1975; Teachers' Center Exchange, 1976, 1977) and there is considerable information available about it. The teachers' center movement, whose goal is to provide a practitioner-run resource-sharing low-cost center in local districts to which teachers can come for self-renewal and new ideas, was facilitated by the government by the creation, on neutral ground, of a center for enhancing local and scattered efforts, through an advice service, production of documents and more occasional work, and training sessions, etc. This seems to have worked well too for this particular innovatory movement, which does not espouse a single ideology (unlike the Individually Guided Education movement (below)), but is for more general renewal purposes.

The social change-related networks are typically decentralized and relatively non-hierarchical in structure. Some are people starting a new approach to teaching and looking for mutual support (e.g., Parker, Laser/Electro-Optics ...., 1976; Claman and Parker, Boston West ... ., 1976; Change in Liberal Education, 1978). These are single-purpose networks, rising and falling as innovations get accepted (e.g., Parker, The Individually Guided Education Movement ...., 1977) or as problems get resolved - as will happen normally if the networks are not institutionalized.

The resource-sharing network in this context often cuts across subject and status lines in pursuit of a deliberate strategy of solving problems on an inter-institutional cross-cutting basis (Eichen, 1977; Sarason and others, 1977; Parker, Northern Westchester ...., 1976). The idea of joining in networks those who are prepared to put in their contributions, irrespective of position, is an important one (Pritchard, 1977). Energy and commitment are crucial.

Other community-level networks that have been organized include the national Parent's Network, which as part of its activities acts as information broker on matters of importance to parents (National Committee for Citizens in Education, 1978), the Educational Confederation, a local organization in network form that cuts across agencies, statuses and subjects (Educational Confederation, 2 references), in a way somewhat similar to the resource networks (Sarason and others, 1977, etc.,) and, presumably, thousands of local informal student networks that provide mutual support and encouragement for learners!

Other networks connect those in similar positions in agencies or organizations, who need support and discussion for dealing with common problems that each has to face separately (Merrow, Foster and Estes, 1974; Parker, The Superintendent's Network ...., 1976). The problems are varied but the position is similar.

A brief summary of stages of development of networks and of network roles and facilitator/hub properties (above, p.28) has already been presented and this will not be repeated here, except to quote Goodlad (1977) on the function of his hub:

> "Informational input regarding extant innovations and potentially useful products, annotated bibliographies, assistance with problem and resource identification, participation in a leadership training program, organization of meetings and conferences, and so on."

It is not possible, on the basis of information available, to give a comparative analysis of costs of networks of different types, including various sources for funding, but with further investigation this could be done.

This brief survey of cases of networks is at the indicative level. With further examination and analysis, it would be feasible to produce a comparative study, focused on issues of particular concern, in the way Parker (1977) has done for social change networks.

Recommendations to Unesco

The main purpose of this analysis has been to achieve a broad and overall perspective on networks through which information, in whatever form, passes, that will be useful in the context of education. The development of the analysis has reached the point of indicating where Unesco might be interested in further investigation by the posing of more specific questions and the examination of more particular areas. This, in general, would seem to be the next stage.

Basically, it would be appropriate for Unesco to consider what areas it wishes to examine more closely and to concentrate on analysis, examination of cases and development of programs in these areas.

With respect to library/information networks, there are several important issues:

(a) to focus further on the question of users, the form in which they need information and the best means of delivering it to them;

(b) to examine the formal system/informal network interface by looking further into such intermediaries as information brokers, gatekeepers, and others who may actively guide and assist users;

(c) to investigate further the informal networks through which STI and other information flows in a useful form, including the best length of information chains, the extent to which sub-networks can be developed through key individuals, etc.;

(d) to consider the most appropriate form and delivery system for innovation-related dissemination, especially low-technology networks that could be set up and let go of in a considerably more flexible manner than formal networks; such networks might find suitable bases for their hubs in many parts of the Unesco structure;

(e) to compare library networks with the news media to discover to what extent outreach can be improved and what lessons news organizations may have to offer, particularly with respect to inputting information and employing strategies and tactics for diffusion, in a fast production cycle, to a wide audience.

Behind these issues stands a more general one about the organization involved, its structure and its model of information and its diffusion. In this connection, the following issues could be addressed:

(a) to investigate more carefully and in more detail the variation in institutional arrangements and ways in which any particular pattern may be appropriate for information networks;

(b) to consider in more detail the issue of centralization and hierarchy in networks of the various types, particularly the influence of the physical network shape on the members of the network and the degree to which centralization can be introduced into a social change network;

(c) to evaluate the two models with which innovation-dissemination can be approached and to consider where each is appropriate and what consequences this has for network design or network intervention;

(d) to investigate possibilities for connecting with social change networks, as the United States government has done, at the international, regional and national levels. In some member countries of Unesco, cooperative networks exist at the community level and might provide some suggestive illustrations for government-community connections. On the international level, non-governmental organizations, or transnational association networks, have been used by Unesco in several activities, e.g., the development of computerized information networks. Other association networks, e.g., teachers' associations, might be worth investigating for possible decentralized information activities.

It would certainly be worth while comparing in greater detail cases of networks of the library/information center type and of the social change type, with respect to the variables brought out earlier in this paper, such as organization, stages of development, formality/informality, low-energy/high-energy, centralization/egalitarianism. More specific questions related to Unesco's mission and goals can be asked.

Another interesting framework from which to analyze different types of information networking, both formal and informal, is from the point of view of the different patterns of procedures for finding, screening, processing, storing and diffusing information in different types of networks. By doing this, it should be possible to discover in further detail some of the general process features of the different types and, in relation to these features, which are the most resource-saving network types to use in particular instances.

The general issue of generation, exchange and dissemination of research information is clearly one that can be investigated more systematically, with more specific recommendations for network development than can be given here. But in this connection, investigation should include the involvement of practitioners and communities, both as sources, as networkers of social change information and as 'researchers' in their own right.

Examination in further detail of networking role elements and network type roles such as broker, gatekeeper and facilitator, particularly in relation to government and formal system interface, would be of great importance. Such roles seem to be an appropriate development from consulting roles, currently in something of a decline in international circles. It may even be possible to develop and tailor some role or set of roles for specific use by the United Nations family. Sufficient experience exists and Unesco could act as a catalyst, both by producing information on networking roles and drawing on consultants who have the experience and themselves are well-connected with networks in various sectors.

The issue of costs of various forms of network, at various stages of network development, could also be investigated with more precision on the basis of information available in this bibliography. Since scarce resources and resource-sharing are important for Unesco and its

Member countries, this issue is of considerable importance.

In conclusion, it is worth stressing an important fact about well-conducted networking efforts that has perhaps been under-stressed in this report. Particularly when networks are low-hierarchy and egalitarian, they bring out considerable enthusiasm and commitment among their members. Members are exchanging and contributing instead of being told what is good for them. The implications of this in a resource-sharing world, where people and institutions are widely-scattered and may feel overwhelmed by the needs they are unable to fulfill, are great and need to be taken extremely seriously.

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